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Abstract

"Scaffoldings" states to let teachers provide a temporary support to help the students developing their self-scaffolding, this temporary support (the scaffolds) might be a kind of teaching facility or teaching strategy, as the capability of the learner advanced, the learning responsibility will shift gradually to the student, finally the student can dominate his/her learning, and through learning he/she shall build up his/her own knowledge. In this study, Internet and the Constructivist Scaffolding Teaching Theories are applied to develop a teaching model based on the "Research Method"- a program for the first year in graduate school, so that information technologies can be applied to make up the teachers' deficiencies in terms of energy, time and capability. On the other hand, taking the advantages of the traditional teaching model face-to-face communication, and interaction to make up the deficiencies of Internet teaching. To realize the effects of this instructional model, experimentation is adopted in this study. Differences of learning results between constructive scaffolding teaching model with Internet assistance (CSTMIA) and the traditional teaching model (TTM) are analyzed.

The result of the study shows: (1) indeed the performance of the CSTMIA better improves the students' learning achievement than that of the TTM, but it is not as good as the traditional teaching in terms of the learning performance, learning satisfaction and the growth of learning capabilities; (2) the result of the subsequent evaluation and analysis shows: based on the subjective realization from more than 60% of the students in the CSTMIA, they are positive toward the capability of such CSTMIA in the improvement of learning performance, learning achievement, learning satisfaction, interaction between teachers and the students, and the growth of learning capabilities, this proves that the CSTMIA implemented by this study helps improve the learning effect, strengthen the interaction between teachers and the students in certain extent. The contributions of this study are: (1) Based on the "Research Method" program, to develop that program's Constructivist Scaffolding Teaching Model supplemented by Internet; (2) Based on the "Research Method" program, to see the influences of the Constructivist Scaffolding Teaching Model supplemented by Internet toward the learning performance, learning achievement, learning Satisfaction, interaction between teachers and the students, and the growth of learning capabilities.

Key words：Scaffolding theory; Internet; Learning performance; Learning Satisfaction ; The growth of learning capabilities

1. Introduction

With the rapid development of technologies, computers can apply in wider areas than before. More and more people use computers on teaching for its convenience of two-way communication, vivid and vigorous media. They hope it can replace the single and dull traditional teaching environment. Moreover, bring about interests of learners to increase their learning effects. This kind of teaching activity with Computer-Based Training is becoming a pedagogical tread (Davis & Davis, 1990). In this study, a teaching model is developed with Internet and constructive scaffolding (CSTMIA) to tie it in the "Research Method" - a program for the first year in graduate school. On the one hand, information technologies can be applied to make up the teachers' deficiencies in terms of energy, time and capability. On the other hand, taking the advantages of face-to-face communication and interaction of the traditional teaching model to make up the deficiencies of Internet teaching.

The developing technologies change the ways of learning and teaching. New teaching techniques should match up new teaching methods to emerge its specialty. The newly web-based instruction is a modern paradigm about applying new teaching media. Alavi (1995) addressed that use information technologies can increase added value of courses, enhance learning effects of learners, improve the effects of collaborative learning and teaching, and lower teachers' loading and total teaching cost. Furthermore, students can be provided more integrated and richer learning contents.

Owing to information techniques highly developing and popularizing quickly, it made a great impact on recent education. To strengthen learning effects of traditional teaching and supplement the weakness of lacking face-to-face interaction in web-based instruction, many teachers and scholars believed information technologies can promote education innovation and renovate traditional teaching (Dexter, Anderson, & Becker, 1999; Dias, 1999). Computer integrated instruction and technology integration are often applied

to highlight the importance of teaching with information technologies integrated (Dias, 1999; Ertmer, Addison, Lane, Ross & Woods, 1999). Apply information technologies to curriculums and classrooms are discussed and it was regarded as a critical topic for curriculum integration with technologies. Many researches show that when implementing teaching with information technologies integrated, patterns and types of teaching will change (Dexter, Anderson, & Becker, 1999; Dias, 1999).

In recent years, computers play important roles in teaching for the advanced hardware and software. It also brings about many impacts on traditional teaching model. At the same time, it drives many studies toward distance teaching with the Internet. Scaffolding learning theories are usually discussed the learning effects in elementary and secondary school, or special education in Taiwan. Up to now, studies of learning effects are short of discussing scaffolding learning theories integrated information technologies for specific courses of university level. However, there have been successful researches brought up in other countries in this field (Kao, Lehman, 1997; Oshima & Oshima, 1999; Kao et al, 1996; Weston & Barker, 2001). Based on the mentioned background, applying Internet and ITs as teaching in universities has been gradually shaping. Internet teaching would be applied wider and wider in the future. The functions shall have more flexibilities and variety. The purpose of this study is to discuss and analyze the effects of CSTMIA for learning the Research Method course in graduate school. Teaching activities are designed under the foundation of scaffolding teaching theories. Analyses of teaching effects are preceded after the actual teaching programs, and then CSTMIA is also established.

According to the findings of relevant researches about scaffolding teaching theories, which would indeed improve learning effects. Hence, the purpose of this research does not lie in validating the scaffolding teaching theories. Instead, if learning effects can be enhanced by CSTMIA is the most concern and important discussion in this study. Therefore, there are several objectives would be achieved:

1. Focus on the course of "Research Methods", the constructive scaffolding teaching model is developed with Internet assistance (CSTMIA).
2. Discuss the differences of learning performance, learning satisfaction, interaction between teacher and students, and the growth of learning capabilities between CSTMIA and TTM.
3. Determine that if CSTMIA strengthen more than TTM in aspects of learning performance, learning satisfaction, interaction between teacher and students, and the growth of learning capabilities.
4. Analyze the influences of teachers' loadings as applying Internet on teaching.

2. Literature Reviews: Scaffolding Teaching Theories

Any pedagogical approach would have its own theories basis and background. Scaffolding teaching theories is derivated from the sect of cognitive psychology; what is more, constructionism and collaborative learning are derivated as well form the same domain. Many relevant researches have proved that scaffolding teaching theories is helpful on promote learning effects. Wood et al. (1976) propose the term of scaffolding in 1976 and its main meaning is: growth of learner's psychological abilities rest on assistance from instructors or high-abilities peers, and this kind of assistance should ground on the learner's organization properties of cognition thereupon. Wood et al. (1976) also summed up six supports that scaffolding can offer: 1. Provoked students' learning, 2. Figured out key characteristics of learning objects, 3. Provided relevant examples for students to inspect and learn, 4. Lightened learning loads, 5. Managed directions of learning activities, and 6. Controlled the discouragement in learning process.

The basic concepts of scaffolding originated from the learning theories proposed by the Russian psychologist Vygotsky. He considered that social meanings and experiences of human cognition development process are transformed in personal and inherent meanings with the steps of innerize or action movements (Vygotsky, 1962). Vygotsky divided the levels of cognition development into real level of development and potential level of development. The former means the level that individuals can solve problems independently; the latter means the level that individuals only can solve problems with guidance or collaboration of others (instructors or high-abilities peer). The difference or gap between these two levels has been named zone of proximal development (ZPD) by Vygotsky (1978).

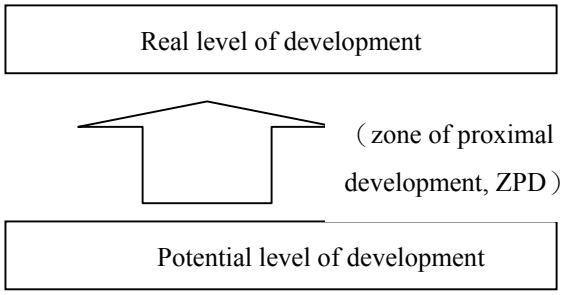

Figure 1: Scaffolding- Zone of proximal development (ZPD)

Scaffolding theory is founded on the concept of ZPD advocated by Vygotsky. Dynamic assessment in teaching, social interactions between learners, and learner's introspection progress are emphasized in this theory. Scaffolding proposes a temporary support to assist students developing their learning capabilities. This temporary support (the scaffolds) might be a kind of teaching facility or teaching strategy, as the capability of the learner advanced, the learning responsibility will shift gradually to the student, finally the student can dominate his/her learning, and through learning he/she shall build

up his/her own knowledge. Therefore, ZPD is regarded as one type of transfer of responsibility in learning processes (Rogoff & Gardner, 1984). Three important conceptions of scaffolding can be summed as follows:

1. In the ZPD, scaffolding supplier (teachers) and receivers (students) have mutually beneficial relationships. The mutually beneficial relationships mean that learning supports of teachers and interaction feedback of students should be decided via negotiation with each other.
2. Teachers ought to gradually shift learning responsibilities to learners, and when is the suitable time will depend on the actual learning states.
3. Communication between teacher and students is the approach that help learners introspect and cognize.

The final purpose of teaching by scaffolding is to achieve learning shifts and self-oriented learning for learners. It would assist learners in developing self-scaffolding for learning. Bickhard (1997) considered that when the scaffolds are defined as simplifying learning background (decrease obsession of choosing) and giving extra supports (guidance of choosing), that will make learners do wise learning. In this moment, learner's self-scaffold is defined that learner can integrate his/her learning content, make extract, and choose it. He/She can also look for outside resource (supports) at the same time. Several points can be concluded as below:

1. Transfer of responsibility: Teaching by scaffolding emphasized that the transfer of teaching will be gradually shifted from instructors to learners.
2. Dialogue of teaching: dialogues in learning progress are strongly stressed, which included instructors to learners and learners to learners.
3. Establish self-scaffolding for learners: The self-scaffolding, learner integration, instructional resource discovery, individual learning, and abilities of evaluating self learning are constructed from teaching by scaffolding.

According to many instruction researches, scaffolding theories is indeed beneficial to learning effects for students. However, teaching by scaffolding are mostly applied to kindergarten level or special education in Taiwan. Up to now, few instructional applications of scaffolding have implemented in university programs, and an instructional model hasn't been designed by using scaffolding with Internet assistance. There are several significant achievements about teaching by scaffolding, which are integrated to instruction media design (Kao & Lehman, 1997；Oshima, Oshima & Ritsuko, 1999；Kao et al., 1996 ； Weston, Barker & Lecia, 2001). A teaching environment of CAI with scaffolding is used to teach statistic for college students and its teaching effects is proven that scaffolding is helpful and useful. Nerveless, teaching methods developed by these studies are almost limited in the scope of experimental teaching. Still more, these methods would cost lots of time or efforts and there are only few methods can be effectively implemented in real teaching environment.

This paper would focus on developing a constructive scaffolding teaching model with Internet assistance (CSTMIA) to actually apply to practical teaching and increase learning effects for students. This CSTMIA teaching model is practically applied to a master degree program of "Research Methods" in graduate school. By using CSTMIA, refining of teaching, adoptive of learning, and improvements of learning effects can be expected.

3. Instruction Design

"Research Methods" is an obligatory course in graduate schools, which is also an important tool to train research abilities of students. Therefore, this course depends on deeply comprehension, discussion, and interaction between teacher and students. In the past, many students often felt confused and can't have in hand after learning it. Characteristics of scaffolding teaching focus on mutual discussion and emphasizing teacher's assistance for students' learning, both are suitable for applying it to this course. For these reasons, an instructional model of CSTMIA is developed for this course, and moreover actually implemented in graduate school to find out its effects or influences on teaching in master degree level.

3.1 Implementation Process

In this study, there are two groups of objects. One group has 23 students, and those are full-time graduate students. The other groups are 25 graduate students, and all of them are at work. A 10-weeks experimental instruction would be preceded in this course at autumn semester in 2001.

To avoid Hawthorne effect, students are not informed that they had been observing in the 10-weeks. All of the learning activities and assessments of students are included in grades counting. All sample in this study are departed into two groups resulted from different teaching methods. The experiment group is those 23 full-time graduate students. The control group is those 25 graduate students at work. These two groups have their own class and these two groups can't do inter–communication easily, that would ensure reliability of this experimental instruction. Students of the experiment group would receive CSTMIA approach in this course; the control group would receive TTM approach in this course. All of these objects are students major in department of MIS in NKFUST, so that all of them have basic abilities about using computers and Internet. Simultaneously, most of them have similar intelligence, similar learning situation, and similar background of domain knowledge. They have little inter-difference on the whole.

3.2 CSTMIA System

The CSTMIA system is constructed for applying to

the course of Research Methods in this study. It has three main parts within this system.

1. Homepage functions: 6 items
   a. Member login: Members can login the learning community, it has a mechanism of password accounting. If someone forgot password, system will e-mail it to him/her.
   b. Professional's bulletin: Nonscheduled articles of professionals would be posted to share or discuss for learners.
   c. Hot news: Latest academic information would be provided to learners.
   d. Top 10: The top 10 warmly discussing articles would be announced.
   e. Daily term: A scholarly term will be introduced for learners each day.
   f. Advertisement blocks: Give advertisement chances for business.

2. On-line Learning: This is the key element in CSTMIA system and it has several functional items. Areas for achievements share, knowledge share, and discussion are three sections.

3. Q&A Services: Providing solutions and answers for learners to clear up common problems of using Internet.

3.3 Instruction Contents

Based on scaffolding theories and relevant literature reviews, three instruction levels are designed to increase learning effects in this study. CSTMIA is developed to facilitate teaching activities; its contents of the three levels are summarized in table 1.

1. The 2-phase instruction: There are two phases instruction of this course. In the first phase, teacher is the core element. This study adopts a pedagogical approach with TTM and web-based learning to be a temporary support, which would help learners develop their learning capabilities. The second phase aims at transferring learning responsibilities to learners. Learners would complete assignment of research proposal by their own knowledge that learned from the first phase.
2. Dialogue of instruction: In the first phase, the dialogue mainly exists between teachers and students. Teachers guide the instruction and makes brainstorming with students, and students can give opinion freely. In the second phase, the dialogue mainly exists among students. Students guide their collaborative learning, and each one should discuss with others.
3. Instruction activities: To promote students discussing and enhance learning abilities, these instruction activities are integrated with CSTMIA. At the beginning of instruction, students are requested to configure their learning responsibilities and learning target. And then, a temporary support with teaching in classroom and web-based teaching are provided to learners, which is a transfer of learning responsibilities from teacher to students. Finally, learners would establish their own self-scaffolding.
4. Instruction process: Constructive is the major principle, and students are principal part of learning. Knowledge would construct from active cognition of learners, rather than being instill it into learners by instructor. Teacher is just a mediator of knowledge, who merely guides students to construct their own knowledge structure.

Table 1: Contents of scaffolding teaching

Contents / Levels of Instruction	CSTMIA
Instruction model	□ 2-phase instruction and dialogue of instruction □ An instructional approach integrated TTM and web-based learning.
Instruction activities	□ Configure learning responsibilities and abilities. □ Transfer of learning responsibilities □ Establish self-scaffolding for learner
Instruction process	□ Constructive

3.4 Design of CSTMIA

Definition of scaffolding is that the growth of psychological capabilities of learner would rely on assistance of instructor or high-ability peers. This kind of assistance should ground on the learner's organization properties of cognition thereupon. Scaffolding can provide several supports for learning: 1. Provoked students' learning, 2. Figured out key characteristics of learning objects, 3. Provided relevant examples for students to inspect and learn, 4. Lightened learning loads, 5. Managed directions of learning activities, and 6. Controlled the discouragement in learning process (Wood, Bruner & Ross, 1976). Instructors supply a temporary support to assist student inspect and learn. This temporary support (the scaffolds) might be a kind of teaching facility or teaching strategy, as the capability of the learner advanced, the learning responsibility will shift gradually to the student, finally the student can dominate his/her learning, and through learning he/she shall build up his/her own knowledge (Rogoff & Gardner, 1984). According to these explanations, the instruction model in this study would aim at characteristics of the "Research Methods" to develop CSTMIA teaching approach.

Hence, the instruction design in this study would base on the viewpoints of scaffolding supports for learning (Wood, Bruner & Ross, 1976). Most of all, Internet assistance would proceed the design of scaffolding teaching in this study. There are three stages in the whole instruction progress, including configure learning responsibilities and target, proceeding of teaching activities, and analysis of learning results. Practical experiment of instruction is 10-week, which is implemented in the course of Research Methods on students in graduate school. Those research objects are graduate students in their first year major in MIS. Tasks of sequential stages of instruction is described as figure 2.

4. Research Methods

4.1 Research Model

This paper mainly focuses on discussing the effects of TTM and CSTMIA. Learning performance (subjective part of cognition and objective part of grades), learning satisfaction, interaction between teacher and student, and growth of learning abilities are factors concerned. Furthermore, still discussed whether CSTMIA strengthen more than TTM in aspects of learning performance, learning satisfaction, interaction between teacher and students, and the growth of learning capabilities. Resulting from these purposes and referring theory background, research model of this study is established as figure 3.

4.2 Variables

Several variables are determined according to the research model. Independent variables and dependent variables are summarized in table 2, and each has specific description of operational definition.

4.2.1 TTM: Traditional teaching means that instructional activities are proceeding in campus or in classrooms. Teacher and students place themselves in the same space. Students have to obey some behavior rules and communication types due to environment conditions. Most teachers still play the roles of teller or disseminator. Learners always passively receive message (Dismuke, 1995).

4.2.2 CSTMIA: The basic concepts of scaffolding originated from the learning theories proposed by the Russian psychologist Vygotsky. Scaffoldings states to let teachers provide a temporary support to help the students developing their self-scaffolding, this temporary support (the scaffolds) might be a kind of teaching facility or teaching strategy, as the capability of the learner advanced, the learning responsibility will shift gradually to the student, finally the student can dominate his/her learning, and through learning he/she shall build up his/her own knowledge (Vygotsky, 1962; Wood et al, 1976). In this study, Internet and the constructivist scaffolding teaching theories are applied to develop a teaching model to be applied to make up the teachers' deficiencies in terms of energy, time and capability.

4.2.3 Learning performance:

Learning performance is an indicator that used to evaluate learners' study achievements, and it's also a main item to assess teaching qualities. Learning types, curriculum design, and instruction methods would influence learning performance. In this study, the evaluation of learning performance will be discussed in two parts. One part of evaluation is preceded with investigating the increase of learning performance when students writing down research proposal. It is also equal to evaluate their subjective cognition of learning performance. The other part of evaluation is to investigate total reputation of learning performance by their grades. Assignment grades, behavior of discussion, and representation in class are included in this part. Therefore, the grade is a kind of objective indicator for evaluating learning performance (Doran & Klein, 1996).

4.2.4 Learning satisfaction: Learning satisfaction can be a pleasure feeling, positive attitude, achievement of wishes or requiring, or awareness of abilities enhancing after students participated in learning activities. Learning satisfaction is a feeling or attitude toward learning activities, and it would resulted from students' preference of learning activities or achievement of wishes or requiring (Knowles, 1970; Ridley, Miller & Williams, 1995).

Table 2: List of research variables

Independent variables	Dependent variables
● TTM ● CSTMIA	● **Learning performance** (subjective part and objective part) ● **Learning satisfaction** ● **Interaction between teacher and students** ● **Growth of learning abilities**

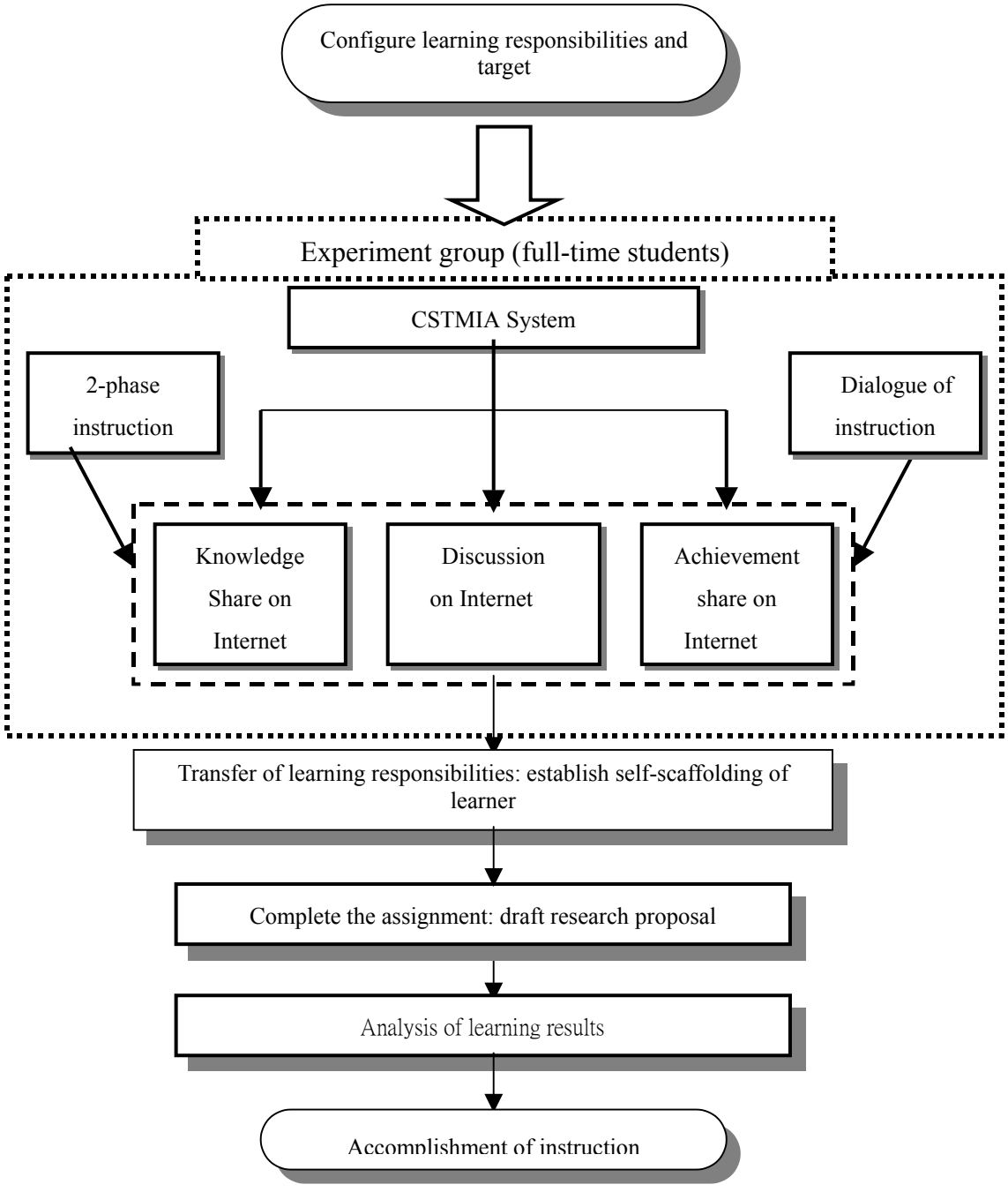

Figure 2: Tasks of sequential stages of instruction

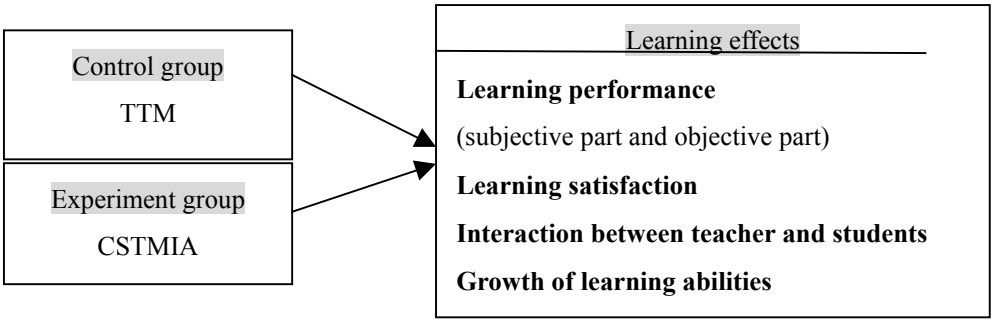

Figure 3: Research model in this study

4.2.5 Interaction between teacher and students:

The process of communication between teacher and students to deliver words or non-verbal with E-mail or discussion areas at class or after class.

4.2.6 Growth of learning abilities:

A set of behaviors or properties for determination, which indicate different level of learners in different attributes. The growth can be used to evaluate learning attitudes, strategy, interest, or the developing states of personality or affection.

There are several hypotheses made and induced from research purposes, reference, and research model in this study.

4.2.7 The prediction of learning effects of CSTMIA and TTM:

Hypothesis 1:
CSTMIA cause better learning effects than TTM.

Hypothesis 1-1:
CSTMIA resulted of better grades of students than TTM.

Hypothesis 2:
CSTMIA cause better learning satisfaction than TTM.

Hypothesis 3:
CSTMIA cause better interaction between teacher and students than TTM.

Hypothesis 4:
CSTMIA cause more growth of learning abilities than TTM.

4.2.8 If CSTMIA enhance more degree of interaction to learning effects than TTM:

Hypothesis 5:
CSTMIA enhance more degree of interaction to learning performance than TTM.

Hypothesis 5-1:
CSTMIA enhance more degree of interaction to learning grades than TTM.

Hypothesis 6:
CSTMIA enhance more degree of interaction to learning satisfaction than TTM.

Hypothesis 7:
CSTMIA enhance more degree of interaction to growth of learning abilities than TTM.

4.3 Questionnaires

There are two questionnaires designed to investigation in this study. One questionnaire is to investigate learning effects. This questionnaire refers to certain related questionnaire and it has validated by domain experts. The other questionnaire is to do subsequent evaluation and analysis. It is used to realize if CSTMIA can really enhance more degree of interaction to learning effects than TTM.

Both questionnaires have meet reliability requirement of Cronbach α (all of them upper are than 0.7). The α of four constructs of learning effects in the first questionnaire are larger than 0.7 (learning performance 0.9008, learning satisfaction 0.8530, interaction 0.8282, growth of learning abilities 0.7749). The α of subsequent evaluation in the second questionnaire is 0.8348. Mention-above shows that questionnaires in this study are suitable and reliable.

4.4 Experiment design

To achieve the research purpose, experiment method is mainly adopted with static-group comparison in this study. Students in the experiment group adopt CSTMIA and the control group would adopt TTM instead. All of them have a 10-week learning schedule, and data collections in this period are served as empirical analysis. Differences between control group and experiment group are discussed, so do hypotheses validation.

4.5 Results

All data of questionnaire are collected and computed by One-way ANOVA method (under .05 significant level) to validate those hypotheses and confirm its effects. The statistic data are arranged in table 3.

Table 3: Statistic results of hypotheses

Hypothese	*p-value*	*Significance*	*Validation results*	
H 1	0.00373	***	Reject	H 1
H 1-1	0.000	***	Non-reject	H 1-1
H 2	0.000	***	Reject	H2
H 3	0.0083	**	Reject	H3
H 4	0.0049	***	Reject	H4
H 5	0.000	***	Reject	H5
H 5-1	0.000	***	Non-reject	H 5-1
H 6	0.000	***	Reject	H6
H 7	0.000	***	Reject	H7

5. Discussion and Conclusion

5.1 The prediction of learning effects of CSTMIA and TTM:

Learning performance, learning satisfaction, interaction, and growth of learning abilities of CSTMIA have significant difference with TTM. The average grades of TTM are higher a bit than CSTMIA. The fact indicates that research results are just opposite to hypotheses. In order to realize this phenomenon, we've interview the teacher of this course and conclude some findings.

1. Students in the control group have stronger learning motives and positive learning attitudes. 2. Although students in the control learned with TTM, they performed better than comparing with the experiment group. Students in the control group always immediately ask questions they don't know in class. 3. Students in the control group have the courage to express their own opinion and viewpoints. They are able to warm discussions and issues without any guidance from teacher. 4. All students in the control group are at work and at least have 5 years experience of working. Their thinking abilities, representations, and achievement of learning target are indeed practiced well than students in the experiment group. 5. Students in the control group have more tricky attitudes on answering questionnaire because of their social experiences, therefore, more bias might be occurs than students in the experiment group as answering questionnaire. For this reason, the control group may have better effects. The subsequent evaluation and analysis can be deeply discussed the limitation to different learning groups in their learning motives.

In the part of learning grades, CSTMIA and TTM have significant difference in statistic analysis. The average grades of CSTMIA group have higher performance than TTM. We concluded several possible reasons of this result. 1. Students in the control group have more tricky attitudes on answering questionnaire because of their social experiences, therefore, more bias might be occurs than students in the experiment group as answering questionnaire. For this reason, the control group may have better effects. 2. Learning grades is a total assessment, including daily performance, participation, assignment, etc. Most of all, the assignment of research proposal has largest proportion of grades, and teacher can grade students subjectively. Those would less cause bias than questionnaires. 3. Broadly, if eliminate the influences of objective factor and do subsequent evaluation to analyze results. CSTMIA would be still helpful to increase learning effects.

5.2 If CSTMIA enhance more degree of interaction to learning effects than TTM:

The level of interaction has positive correlation with learning performance, learning grades, learning satisfaction and growth of learning abilities. These results indicate that the more degree of interaction, the better learning effects would appear. If we can design certain mechanism that would stimulate students' participation, it would be a critical factor to increase learning effects. For example: apply a director of discussion area. The director would lead discussion, address issues, and make summary. If the director can lead members discuss some questions smoothly, learners will get used to this style of discussion. The discussion area will have its practical effects, and will enhance interaction between teacher and students to increase learning effects.

Although CSTMIA can merely increase learning grades as enhancing interaction to learning effects, learning performance, learning satisfaction, and growth of learning effects are not significant. After further investigation of this event, certain important clues can help to determine these appearances. The two samples of this study have great difference in learning motives, learning wills, learning enthusiasm, and participation. In other word, these two groups have inequality on their learning attitudes, and it will lead to worse results of experimental instruction. But it doesn't mean that CSTMIA is not good in this study, instead, most illnesses come from nature difference of samples.

There are some findings after the subsequent evaluation. Students in the experiment group adopt positive attitudes toward the CSTMIA approach. Therefore, CSTMIA is considered as beneficial tool and it would useful on increasing learning effects and enhancing interaction between teacher and students.

5.3 Impacts of teachers' loading as applying Internet to assist teaching:

After interviewing the teacher of this course, we concluded some findings. 1. It would shorten teacher lots of time and efforts on lecture by applying Internet to supports of examples, students can also easily learned key characteristics of learning objects. 2. The discussion area of CSTMIA system provides an on-line space to discuss, interact, and solve problems for teacher and students. They can communicate with each other and

lighten their learning loads of discussion as well. 3. Teacher can notice learning states of each student through discussion area. Teacher can also arrange instruction resource according to students' situation, which will decrease waste of efforts and shorten loads of time.

5.4 Discussion and analyses of the subsequent evaluation:

The subsequent evaluation is quoted to comprehend students' subjective cognition about CSTMIA. We would like to know if CSTMIA could enhance more degree of interaction to increase learning effects after finishing the course of Research Methods. After analysis of the subsequent evaluation, more than 60% students in experiment group adopt positive attitudes toward effects of CSTMIA. They agree with the capability of such CSTMIA in the improvement of learning performance, learning achievement, learning satisfaction, interaction between teachers and the students, and the growth of learning abilities. This proves that the CSTMIA implemented by this study helps improve the learning effect, strengthen the interaction between teachers and the students in certain extent. The worse experiment results come from inequality on their learning attitudes of these two groups, and it will be influenced by man-made factors or subjective factors.

6. Contribution and Limitation

1. **Establish a constructive scaffolding teaching model with Internet assistance on the course of Research Methods.**

Scaffolding learning theories are usually discussed the learning effects in elementary and secondary school, or special education in Taiwan. Up to now, studies of learning effects are short of discussing scaffolding learning theories integrated information technologies for specific courses of university level or other higher education. Still more, these methods would cost lots of time or efforts and there are only few methods can be effectively implemented in real teaching environment. Hence, the first contribution of this study is to develop a CSTMIA pedagogical approach for actual practice to increase learning effects and being a basis for future reference by related courses.

2. **Discuss the influence of CSTMIA to learning performance, learning grades, interaction, and growth of learning abilities.**

Research Methods is an obligatory course in graduate schools, which is also an important tool to train research abilities of students. Therefore, this course depends on deeply comprehension, discussion, and interaction between teacher and students. In the past, many students often felt confused and can't have in hand after learning it. Characteristics of scaffolding teaching focus on mutual discussion and emphasizing teacher's assistance for students' learning, both are suitable for applying it to this course. For these reasons, an instructional model of CSTMIA is developed for this course, and moreover actually implemented in graduate school to find out its effects or influences on teaching in master degree level.

3. **Provide future reference for related studies**

There are still few studies discussing about developing a scaffolding teaching model with Internet assistance in Taiwan. It is trusted that, results of this study can be a foundation of related studies and being a headstone for future complete model. For instance, sample selection ought to be more homogeneous in future days. The records of system logs about students' activities on web may be used to analysis. Adjust the proportion of grades on the part of participation and discussion to encourage students actively learning and discussion. Increase other assessment of performance evaluation in the initial stage and middle stage of semester, which will help to interpret learning curve in the process.

Undoubtedly, there are still some limitations in this study. On sample selection, it doesn't follow the principle of complete random sampling. Because the instruction experiment is practiced with unit of class, external validity may be influenced by the limitation of self-selection. That will make inference incomplete. Furthermore, the length of period of experiment time may influence learning effects too. Two conditions of time may be included for future discussion: Is a 10-week cycle of experiment appropriate? Is on-line time of using Internet resource will influence learning wills? Finally, bias of research data collection may be influenced by subjective factors of students. Those subjective factors can be personality or learning styles of students, or students' identification of teacher or this course. Most of these factors would influence research results.

Reference

1. Alavi, M., B. C. Wheeler and J. S. Valacich, 1995, "Using IT to Reengineer Business Education: An Exploratory Investigation of Collaborative Telelearning," MIS Quarterly, Vol.19, pp.293-312.
2. Bickhard, M.H.,1997, " Constructivism and Relativisms：A shopper's guide," Science & Education, Vol.6, ppt.29-42.
3. Davis, D. L. and Davis, D. F., 1990 "The Effect of Training Techniques and Personal Characteristics on Training End Users of Information Systems," Journal of Management Information System, Vol.7, No.2, pp.93-110.
4. Dexter , S L., Anderson, R. E., & Becker , H.J.,1999, "Teachers' views of computers as caralysts for changes in their teaching practice," Journal of Research on Computing in Education,Vol.31, No.3, pp.221-239.

5. Dias, L.B., 1999, "Integrating technology : some things you should know," Learning & Leading with Technology , Vol.27, No.3, pp.10-13, 21.
6. Dismuke, C., 1995, Distance education [online], Available: http://userwww. sfsu.edu/~Scarloyn/thesis.html.
7. Doran, M. S., & Klein, J. D., 1996, "The effect of learning structures on student achievement and attitude using a computer simulation,"(ERIC Document Reproduction Service No. ED 397 788)
8. Ertmer P,A., Addison, P., Lane,M., Ross, E.,& Woods,D., 1999, " Examining teachers' beliefs about the role of technology in the elementary classroom," Journal of Research on Computing in Education, 32 (1), 54-72.
9. Kao, Michelle T.; Lehman, James D., 1997, "Scaffolding in a Computer-Based Constructivist Environment for Teaching Statistics to College Learners," Chicago, March 24-28.
10. Kao, Michelle T.; And Others, 1996, "Scaffolding in Hypermedia Assisted Instruction: An Example of Integration," 18th National Convention of the Association for Educational Communications and Technology, Indianapolis, IN.
11. Knowles, M. S., 1970, The modern practice of adult education. New York: Association.
12. Rogoff, B., & Gardner, W., 1984, Adult guidance of cognitive development. In B. Rogoff & J. Lave （Eds）, Everyday cognition: Its development in social context （ pp.95-116 ） . Cambridge, MA: Harvard University Press.
13. Ridley, D. R., Miller, B. G., & Williams, C. H., 1995, The 1995 assessment report on CNU online.（ERIC Document Reproduction Service No. ED 397070）
14. Slavin, R.E., 1990, " Synthesis of research on cooperative learning, " Educational Leadership, Vol.48, No.2, pp.71-82.
15. Oshima, Jun; Oshima, Ritsuko, 1999, "Scaffolding for Progressive Discourse in CSILE: Case Study of University Undergraduate Programs, " Montreal, Quebec, Canada, April 19-23.
16. Vygotsky, L.S., 1962, Thought and language. (E. Hanfmann & G. Vakar, Eds. And Trans.). Cambridge, MA: The MIT. Press(Original work published 1934)
17. Weston, Tim J.; Barker, Lecia, 2001, "Designing, Implementing, and Evaluating Web-based Learning Modules for University Students, " Educational Technology, Vol.41, No.4, p15-22, Jul-Aug.
18. Woolfolk, A. E., 1993, Educational psychology, 5th ed.,Allyn & Bacon., Boston.
19. Wood, D.; Bruner, J. S. & Ross, G, 1976, "The role of tutoring in problem-solving," Journal of Child Psychology and Psychiatry, Vol.17, pp.89-100.